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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

OIPE JC152 OCT 15 2001 PATENT & TRADEMARK OFFICE

In re Patent Application of

JOHANSSON et al.

Serial No. 09/659,377

Filed: September 7, 2000

Atty. Ref.: 1585-280

Group: 3651

Examiner: unknown

For: OPTIMIZED CRITICAL POWER IN A FUEL BUNDLE WITH PART LENGTH RODS

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October 15, 2001

Assistant Commissioner for Patents
Washington, DC 20231

RECEIVED
OCT 19 2001
GROUP 3600

Sir:

10/17/2001 HWOLDER1 00000080 09659377
01 FC:102 84.00 OP
02 FC:103 54.00 OP

PRELIMINARY AMENDMENT

In order to place the above-identified application in the same condition as in the related Reexamination Proceeding No. 90/005,098, please amend the application as follows:

IN THE SPECIFICATION

Please substitute the following paragraph in the specification for the corresponding paragraph previously presented.

Column 10, line 65, amend the paragraph as follows:

A/ Cont.

The reader will realize that in this latter design, decreasing spacer pitch occurs at that portion of the fuel bundle wherein the void fraction increases. In the above described

A1 Cancel.

embodiments, a single length for the partial length rods P has been specified for each bundle. Alternatively, all of the partial length rods within a bundle may have different lengths.

IN THE CLAIMS

Cancel claims 72-74; add claims 75-106 and then cancel the same claims 75-106 and add new claims 107-109 as follows:

A2 Cancel.

75. The invention of claims 35 or 45, wherein another portion of said plurality of fuel rods are full length fuel rods, and said swirl vanes are positioned adjacent at least one full length fuel rod.

76. The invention of claims 35 or 45, wherein said swirl vanes are positioned adjacent at least one part length fuel rod.

77. The invention of claims 1, 15, 28, or 35, wherein another portion of said plurality of fuel rods are full length fuel rods.

78. The invention of claims 1, 15, 28, or 35, wherein said first and second groups of spacers comprise seven or more spacers.

79. A fuel bundle for a boiling water nuclear reactor, the reactor including water in a lower region and water and steam in an upper annular flow region, the fuel bundle comprising:

a plurality of fuel rods in spaced apart relationship containing a fissile material for producing a nuclear steam generating reaction in the reactor:

a lower support for supporting lower ends of the fuel rods in the lower region:

an upper support for supporting upper ends of at least some of the fuel rods in the upper annular flow region:

wherein a first group of said rods are full length fuel rods extending between upper and lower supports, and a second group of said fuel rods are part length fuel rods extending between said lower support and a position intermediate said upper and lower supports, said part length fuel rods causing decreased pressure drop in the upper annular flow region during the nuclear reaction:

a plurality of spacers provided intermediate said upper and lower supports, maintaining said fuel rods in the spaced apart relationship:

wherein at least one spacer includes at least a pair of flow obstructions, one flow obstruction being positioned adjacent a part length fuel rod, and the other flow obstruction being positioned adjacent a full length fuel rod, for restoring at least a portion of the decreased pressure drop and achieving an increase in critical power.

80. The invention of claim 79, wherein the at least one spacer includes a plurality of flow obstructions positioned adjacent a plurality of fuel rods.

81. The invention of claim 79, wherein said plurality of spacers includes spacers in said lower region and spacers in said upper annular flow region.

82. The invention of claim 79, wherein said plurality of spacers comprise seven or more spacers.

83. A fuel bundle for a boiling water nuclear reactor, the reactor including water in a lower region and water and steam in an upper annular flow region, the fuel bundle comprising:

a plurality of fuel rods in spaced apart relationship containing fissile material for providing a nuclear steam generating reaction in the reactor;

a lower support for supporting lower ends of the fuel rods in the lower region;

an upper support for supporting upper ends of at least some of the fuel rods in the upper annular flow region;

wherein a first group of said fuel rods are full length fuel rods extending between said upper and lower supports, and a second group of said fuel rods are part length fuel rods extending between said lower support and a position intermediate said upper and lower supports, said part length fuel rods causing decreased pressure drop in the upper annular flow region during the nuclear reaction;

a first plurality of spacers at least in the lower region maintaining the spaced relationship of the fuel rods, the first plurality of spacers having a first vertical distribution; and

a second plurality of spacers at least in the annular flow region for maintaining the spaced relationship of the fuel rods, having a second vertical distribution that is smaller than the first vertical distribution, wherein the smaller vertical distribution of the second plurality of spacers restores a portion of the decreased pressure drop and achieves an increase in critical power.

A2 cont.

84. The invention of claim 83, wherein at least one spacer includes a flow obstruction adjacent a full length fuel rod.

85. The invention of claim 83, wherein at least one spacer includes a flow obstruction adjacent a part length fuel rod.

86. The invention of claim 83, wherein said plurality of fuel rods define a 9x9 matrix.--

87. The invention of claim 83, wherein said plurality of fuel rods define a 10 x 10 matrix.

88. The invention of claim 83, wherein all of said part length fuel rods have different lengths.

89. The invention of claim 83, wherein one full length fuel rod is provided between at least two of said part length fuel rods.

A2 Cont.

90. The invention of claim 83, wherein said spacers include ferrule spacers.

91. The invention of claim 83, wherein the uppermost spacer is an inconel spacer having low pressure drop and minimal pressure drop on passing two phase flow in the upper annular flow region.

92. The invention of claim 83, further comprising a water rod having additional water therein adjacent said plurality of fuel rods for moderating fast neutrons to thermal neutrons.

93. The invention of claim 83, wherein said first plurality of spacers and said second plurality of spacers comprise seven or more spacers.

94. A fuel bundle for a boiling water nuclear reactor, the reactor including water in a lower region and water and steam in an upper annular flow region, the fuel bundle comprising:

a plurality of fuel rods in spaced apart relationship containing a fissile material for producing a nuclear steam generating reaction in the reactor;

a lower support for supporting lower ends of the fuel rods in the lower region;

an upper support for supporting upper ends of the fuel rods in the upper annular flow region;

a plurality of spacers provided intermediate said upper and lower supports, maintaining said fuel rods in the spaced apart relationship;

wherein a portion of said fuel rods are part length fuel rods extending between said lower support and a position intermediate said upper and lower supports, said part length fuel rods causing decreased pressure drop in the upper annular flow region during the nuclear reaction; and

means at least in the upper annular flow region positioned at a location other than locations above the part length fuel rods for restoring at least some of the decreased pressure drop realized by said part length fuel rods whereby improved critical power performance is achieved at said fuel bundle having said part length fuel rods.

95. The invention of claim 94, wherein said means for restoring at least some of the decreased pressure drop restores part but not all of said decreased pressure drop realized by said part length fuel rods.

96. The invention of claim 94, wherein said means for restoring at least some of the decreased pressure drop includes decreased spacer pitch at least in the upper annular flow region.

97. The invention of claim 94, wherein the means for restoring at least some of the decreased pressure drop includes vanes attached to at least a portion of said spacers.

A2 cont

98. The invention of claim 94, wherein said means for restoring at least some of the decreased pressure drop includes a vane adjacent a part length fuel rod.

99. The invention of claim 94, wherein said plurality of fuel rods further includes full length fuel rods extending between said upper and lower supports.

100. The invention of claim 99, wherein said means for restoring at least some of the decreased pressure drop includes a vane adjacent a full length fuel rod.

101. The invention of claim 94, wherein each said spacer includes a plurality of interstices and said means for restoring at least some of the decreased pressure drop includes vanes proximate the interstices of at least one spacer.

102. The invention of claim 101, wherein said means for restoring at least some decreased pressure drop includes vanes proximate the interstices of the spacers upper annular flow region.

103. The invention of claim 101, wherein said means for restoring at least some of the decreased pressure drop includes vanes proximate the interstices of at least one of said spacers located below a termination point of said part length fuel rods.

A2 Cont.

104. A fuel bundle for a boiling water nuclear reactor, the reactor including water in a lower region and water and steam in an upper annular flow region, the fuel bundle comprising:

a plurality of fuel rods in spaced apart relationship containing a fissile material for producing a nuclear steam generating reaction in the reactor;

a lower support for supporting lower ends of the fuel rods in the lower region;

an upper support for supporting upper ends of the fuel rods in the upper annular flow region;

a plurality of spacers provided intermediate said upper and lower support, each said spacer including a plurality of interstices through which said fuel rods pass, said spacers maintaining said fuel rods in the spaced apart relationship;

wherein a first portion of said fuel rods are full length fuel rods extending between said upper and lower supports, and a second portion of said fuel rods are part length fuel rods extending between said lower support and a position intermediate said upper and

lower supports, said part length fuel rods causing a decreased pressure drop in the upper annular flow region during the nuclear reaction; and

a plurality of vanes, at least one of said vanes attached proximate each interstice of at least one spacer, for restoring at least some of the decreased pressure drop realized by said part length fuel rods whereby improved critical power performance is achieved at said fuel bundle having said part length rods.

105. The invention of claim 104, wherein said vanes are provided proximate each interstice of said spacers in the annular flow region.

106. The invention of claim 104, wherein said vanes are provided proximate each interstice of at least one of said spacers located below a termination point of said part length fuel rods.

107. The invention of claim 15 and wherein said means associated with at least some of said second group of spacers includes vanes attached to said spacers.

108. In a boiling water reactor having discrete bundles of fuel rods confined within channel enclosed fuel assemblies wherein said fuel bundle includes:

a plurality of fuel rods for placement within said channel, each said fuel rod containing fissile material for producing a nuclear reaction when in the presence of sufficient moderating water coolant and moderated neutrons;

a lower tie plate for supporting said bundle of fuel rods within said channel, said lower tie plate joining the bottom of said channel to close the bottom end of said channel, said lower tie plate providing defined apertures for the inflow of water coolant in said channel between said fuel rods for generation of steam during said nuclear reaction;

said plurality of fuel rods extending from said lower tie plate wherein a single phase region of said water in said bundle is defined to an upward portion of said bundle wherein an upper annular flow regime of said water and steam in said bundle is defined during said nuclear reaction in said fuel bundle;

an upper tie plate for supporting the upper end of said bundle of fuel rods, said upper tie plate joining the top of said channel, said upper tie plate providing apertures for the outflow of water and generated steam in said channel during said nuclear reaction;

spacers, each defining a matrix of individual fuel rod cells, located intermediate said upper and lower tie plates at preselected elevations along said fuel rods for maintaining said fuel rods in spaced apart location along the length of said fuel assembly including a first group of spacers in said single phase region of said fuel bundle and a second group of spacers in said upper annular flow regime of said fuel bundle;

a portion of said plurality of fuel rods being part length fuel rods extending from said lower tie plate towards said upper tie plate, said part length fuel rods terminating at ends within said upper annular flow regime of said fuel bundle before reaching said upper tie plate and causing decreased pressure drop in said upper annular flow regime of said fuel bundle during said nuclear reaction;

the improvement to said bundle comprising:

means associated with at least some of said second group of spacers in said upper annular flow regime of said fuel bundle for restoring at least some of the decreased pressure drop realized by said part length fuel rods whereby improved critical power performance is achieved at said fuel bundle having said part length fuel rods, said means including an additional spacer in said upper annular flow regime to thereby decrease spacer pitch in said upper annular flow regime as compared to spacer pitch in said single phase region of said fuel bundle.

A2 cancelled

109. The invention of claim 15 wherein said means are provided in all of said second group of spacers in said upper annular flow regime of said fuel bundle.

REMARKS

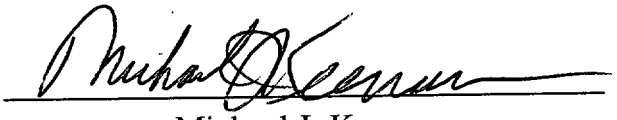
This preliminary amendment places this Reissue application in the same condition as the corresponding Reexamination No. 90/005,098 with respect to both the specification and claims. Thus, in order to insure commonality of claim numbers, applicant has added claims 75-106 but has also requested these claims be immediately cancelled. As a result, the pending claims 15, 16, 20, 22-44 and 107-109 are now identical in content and by number to the claims in the corresponding Reexamination proceeding.

The amendment to Column 10 of the patent is now properly presented relative to the original text in the patent, with added language underlined. Should the USPTO merge the two proceedings as previously requested, subsequent amendments will be made in the manner called for in Section 2285C.

Action on the merged proceedings under the normal Reissue rules is requested.

Respectfully submitted,

NIXON & VANDERHYE P.C.

By: 

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

365/8

In re Patent Application of

Atty Dkt. 1585-280
C# M#

JOHANSSON et al.

Group Art Unit: 3651

Serial No. 09/659,377

Examiner: unknown

Filed: September 7, 2000

Date: October 15, 2001

Title: OPTIMIZED CRITICAL POWER IN A FUEL BUNDLE WITH PART LENGTH RODS

OCT 15 2001
PATENT & TRADEMARK OFFICE

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OCT 19 2001
GROUP 3600

Assistant Commissioner for Patents
Washington, DC 20231

Sir:

RESPONSE/AMENDMENT/LETTER

This is a response/amendment/letter in the above-identified application and includes an attachment which is hereby incorporated by reference and the signature below serves as the signature to the attachment in the absence of any other signature thereon.

Fees are attached as calculated below:

Total effective claims after amendment **32** minus highest number previously paid for **29** (at least 20) =	3	x	$ 18.00		$	54.00
Independent claims after amendment **6** minus highest number previously paid for **5** (at least 3) =	1	x	$ 84.00		$	84.00
If proper multiple dependent claims now added for first time, add $280.00 (ignore improper)					$	0.00
Petition is hereby made to extend the current due date so as to cover the filing date of this paper and attachment(s) ($110.00/1 month; $400.00/2 months; $920.00/3 months)					$	0.00
Terminal disclaimer enclosed, add $ 110.00					$	0.00
☐ First/second submission after Final Rejection pursuant to 37 CFR 1.129(a) ($740.00) ☐ Please enter the previously unentered , filed ☐ Submission attached					$	0.00
				Subtotal	$	**138.00**
If "small entity," then enter half (1/2) of subtotal and subtract ☐ Applicant claims "small entity" status. ☐ Statement filed herewith					-$	0.00
Rule 56 Information Disclosure Statement Filing Fee ($180.00)					$	0.00
Assignment Recording Fee ($40.00)					$	0.00
Other:						**0.00**
				TOTAL FEE ENCLOSED	$	**138.00**

The Commissioner is hereby authorized to charge any deficiency in the fee(s) filed, or asserted to be filed, or which should have been filed herewith (or with any paper hereafter filed in this application by this firm) to our Account No. 14-1140. A duplicate copy of this sheet is attached.

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By Atty: Michael J. Keenan, Reg. No. 32,106

Signature: Michael J. Keenan

PATENT APPLICATION FEE DETERMINATION RECORD

Effective October 1, 2000

Application or Docket Number: 09/659377

CLAIMS AS FILED - PART I

	(Column 1)	(Column 2)
TOTAL CLAIMS		
FOR	NUMBER FILED	NUMBER EXTRA
TOTAL CHARGEABLE CLAIMS 20	29 minus 20=	* 3
INDEPENDENT CLAIMS 4	5 minus 3 =	* 1
MULTIPLE DEPENDENT CLAIM PRESENT		☐

* If the difference in column 1 is less than zero, enter "0" in column 2

SMALL ENTITY TYPE ☐		OR	OTHER THAN SMALL ENTITY	
RATE	FEE		RATE	FEE
BASIC FEE	355.00	OR	BASIC FEE	710.00
X$ 9=		OR	X$18=	54
X40=		OR	X80=	80
+135=		OR	+270=	
TOTAL		OR	TOTAL	844

CLAIMS AS AMENDED - PART II

Rec. 11

AMENDMENT A	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA
Total	* 32	Minus	** 29	= 3
Independent	* 6	Minus	*** 5	= 1
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM				☐

SMALL ENTITY		OR	OTHER THAN SMALL ENTITY	
RATE	ADDITIONAL FEE		RATE	ADDITIONAL FEE
X$ 9=		OR	X$18=	54.00
X40=		OR	X80= 84	84.00
+135=		OR	+270=	
TOTAL ADDIT. FEE		OR	TOTAL ADDIT. FEE	Paid

AMENDMENT B	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA
Total	*	Minus	**	=
Independent	*	Minus	***	=
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM				☐

RATE	ADDITIONAL FEE		RATE	ADDITIONAL FEE
X$ 9=		OR	X$18=	
X40=		OR	X80=	
+135=		OR	+270=	
TOTAL ADDIT FEE		OR	TOTAL ADDIT. FEE	

AMENDMENT C	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA
Total	*	Minus	**	=
Independent	*	Minus	***	=
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM				☐

RATE	ADDITIONAL FEE		RATE	ADDITIONAL FEE
X$ 9=		OR	X$18=	
X40=		OR	X80=	
+135=		OR	+270=	
TOTAL ADDIT. FEE		OR	TOTAL ADDIT. FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20."
***If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3."
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.